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AN AUTOMATED HEADCOUNT SYSTEM

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Army Natick Laboratories
Natick, Massachusetts

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AN AUTOMATED HEADCOUNT SYSTEM

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13. ABSTRACT

SIGNATURE HEADCOUNT ABSTRACT

The signature requirement in the present dining hall headcount system is believed to be a significant troop irritant. This reason among others has stimulated a search for alternative systems which will remove the signature requirement while maintaining an audit trail.

Alternative automated headcount systems can be classified into four basic types: 1) real-time data processing, 2) real-time data collection, 3) off-line cassette output and 4) off-line optical scanner systems. Estimated costs of Army-wide adoption were obtained from a survey of 85 manufacturers. The costs ranged from \$2-\$21 million.

A brief test of the off-line cassette system on embossed meal cards was made during the CAFe experiment at Fort Lewis, Washington. The results of this test suggest that off-line cassette systems and embossed meal cards may not be suitable replacements for the present signature headcount system.

A real-time data collection system was also tested during the CAFe experiment and in subsequent operation of the central food processing facility at Fort Lewis. Social Security Numbers were punched in plastic meal cards. When the card was inserted into dining hall card readers, the information was captured immediately on computer compatible magnetic tape.

A limited comparison of probable unauthorized access rates under the manual and the real-time headcount system indicate that the real-time system will repay its cost in one year in a 24,000 meal per day food service system. Evidence and additional advantages of the real-time data collection system are presented. A real-time data collection system is recommended to replace the present signature headcount system and to remove cash collections from dining halls.

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FOREWORD

In 1969 the DOD Facilities and Equipment Planning Board accomplished an on site survey of military garrison feeding facilities in the United States. As a result of this survey, this Board created a project to study, define, and then implement a new modern feeding system at Fort Lewis, Washington. The objectives were to improve performance and reduce costs. This new system would then serve as a model for all military service.

In 1970 the DOD Food Research and Development Program was established at Natick Laboratories. Included within this program were an increased emphasis on garrison feeding systems and a requirement to study military feeding systems as a total systems concept. The above project was then merged with this requirement and a comprehensive study was initiated by the Operations Research and Systems Analysis Office in November 1970, as Task 03 under Project Number 1J662713AJ45, Systems Studies in Military Feeding.

A significant part of this study effort was to review and evaluate the current Signature Headcount System. This report focuses upon an automated data collection system utilized during the CAFe experiment at Fort Lewis, Washington as an alternative to the Signature Headcount System. The current manual headcount system is contrasted with the automated version with respect to two basic requirements:

- 1) As a control mechanism to limit access to military dining facilities to authorized personnel in accordance with existing regulations
- 2) To provide an audit trail for fiscal accountability.

The application of automated headcount equipment to cash collections will also be briefly described.

Since evaluating an alternative to the existing signature headcount system was considered in terms of applications to all aspects of centralized food preparation, the system described herein has many applications beyond accountability and control requirements. These applications will be presented in a following report, which describes the management information system required to effectively operate a centralized feeding facility.

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ABSTRACT

The present signature headcount system is designed to:

- 1) control access to military dining facilities in accordance with existing regulations,
- 2) provide an audit trail for fiscal accountability,
- 3) record headcounts which will assist the dining facility steward in predicting demand and ordering rations accordingly.

In fulfilling these functions, however, the signature requirement is believed to be a significant troop irritant. This is but one of several reasons which have stimulated studies to define and evaluate alternative headcount systems.

This report describes several kinds of alternative automated systems; two of which were utilized during the CAFe experiment at Fort Lewis, Washington. An off-line cassette-output system was used in an initial phase of the study. This system was subsequently replaced with a real-time data collection system which was utilized from 4 November 1971 to 31 June 1972.

In a preliminary survey of equipment manufacturers, the estimated cost of procuring automated headcount systems for Army-wide application was found to range from \$2-21 million. The real-time data collection system utilized most extensively at Fort Lewis was estimated to cost approximately \$5 million if implemented on an Army-wide basis (assuming the 600 installations and 4,000 dining halls operating at the time of the survey).

The number of potentially unauthorized meals was estimated for a 24,000 meal per day food preparation facility given signature headcount and automated controls as they existed in sample dining facilities. Assuming a raw food cost of \$1.51 per day, potential losses under the manual and automated headcount system would be approximately \$338,000 and \$99,000 respectively. The difference of approximately \$239,000 would more than cover the purchase costs and installation of a real-time data collection system such as that proposed in this report.

Evidence also indicates that the proposed automated headcount system.

- 1) can reduce waiting in line at the headcount station
- 2) received favorable consumer reaction
- 3) can perform with sufficient reliability to remove cash collections from the dining hall
- 4) does provide a reliable, legible audit trail.

Based upon the evidence summarized in this and other reports, a real-time headcount data collection system is required to effectively operate the proposed centralized feeding system. The real-time headcount system may also be an effective replacement for the signature requirement in existing food service systems on large installations.

INTRODUCTION

Many kinds of information are required to effectively operate a feeding system. Among these, headcount data stands out as one of the key elements. At least two of the eight Food Service Objectives specified in AR 30-1 (see Ref. 1) pertain directly to the collection and uses of headcount information:

- (3) modernization, standardization, and automation of menu and recipe service, food acceptability determination, ... requisitioning and inventory control ...
- (4) standardization and automation of accounting and reporting to include positive, auditable headcount procedures which will identify entitlement classification of persons fed ...

These objectives clearly indicate the importance of automated headcount data collection in food service.

The importance of changing existing headcount procedures is recognized by other levels of the Army's top management — though for reasons other than improved food service. The signature requirement is believed to be a significant troop irritant. As such, it is a barrier to retaining — or attracting — qualified career personnel.

There is an additional argument for changing the existing manual signature headcount system. As will be shown in a subsequent section of this report, the present method does not control unauthorized access to dining facilities as effectively as the proposed alternative system.

Considered together, the above objectives establish a clear requirement for an automated data collection system with the following capabilities:

- a) record headcount according to rations-in-kind, cash collections, and cross-service reimbursements
- b) provide a clear and reliable audit trail

- c) capture individual food choice/acceptability data on a sampling basis
- d) capture and integrate information required to produce requisitions (e.g. estimated troop strengths, current inventory, food preferences).

Obviously there are many possible combinations of computer equipment and programs which can be designed to accomplish these requirements. This report will describe in detail only one type of automated system. The particular equipment and programs were introduced as part of the Centralized Army Feeding Experiment (CAFe) conducted at Fort Lewis, Washington in August, September and October 1971.

The signature headcount requirement was eliminated. Machine-readable plastic meal cards were utilized to record headcount, control access, and provide a legible, reliable audit trail. Headcount data were combined with automatically recorded food choice information to control food production. The equipment was used not only to record headcount, but to update menu and recipe files as well.

In short, it was shown that an automated headcount system can meet the requirements specified earlier. It is, for example, technologically feasible to remove cash collections from the dining halls. This can be done with available hardware -- and with the same equipment that records ration-in-kind headcounts. But the application to cash collections, as is true of other applications, will require policy decisions not yet made.

MANUAL HEADCOUNT SYSTEMS

Basically, a headcount system is composed of procedures, personnel, forms and reports required to perform three functions:

- 1) control access to dining facilities
- 2) account for rations fed
- 3) record headcount for predicting demand and requisitioning rations accordingly.

Existing regulations, procedures, forms and reports comprise one type of headcount system. It is basically a manual system wherein the above functions are performed almost entirely without the use of ADP equipment. A complete description of the existing signature headcount system can be found in Army Regulation 30-1, "The Army Food Service Program". It is not necessary, therefore, to describe it further in this report.

AUTOMATED HEADCOUNT SYSTEMS

There are two "building blocks" in the alternative systems to be described in this report. The first is a machine readable meal card. The second is the data collection equipment utilized in capturing the information encoded on the meal cards.

Careful consideration must be given to the kind of meal card and coding schemes utilized in an automated headcount system. Over the long term, meal cards can serve several functions. They could be utilized as "credit" cards in commissary resale as well as in dining facilities. They could also serve identification purposes. Presently an individual is required to present his meal card (DD form 714) as well as his ID card to the headcounter. A picture on the meal card would serve to identify the holder. The meal card and ID card thus need not be two separate documents.

Meal Cards

Three primary processes are used to enter information onto meal cards. There are 1) embossed characters, 2) punched holes, 3) magnetic tape strips. Figure 1 summarizes the general advantages and disadvantages associated with each of these encoding processes.

Experience with the embossed and punched-hole cards was gained during the test at Fort Lewis, Washington. This experience indicated that the hole punched cards are preferable at least to the embossed cards. Further discussion of this experience will be presented in a subsequent section of this report.

Data Collection Equipment

In March, 1971, an industry survey was initiated to define alternative data acquisition systems of potential use in eliminating the signature requirement. More than eighty companies were contacted with regard to what type of equipment is — or could be made — available. Fifteen companies were identified that offered an equipment configuration which would meet the control and accountability requirements presently served by the signature headcount system.

FIGURE 1

MEAL CARD ENCODING PROCESS

	Embossed	Holes	Magnetic Strip
Decimal Digit Capacity ¹	Low (1-22)	Low (1-22)	High (1-100+)
Card Preparation Equipment - Cost (per unit) ¹	Low (\$2,000)	Low (\$1,000)	High
Card Preparation Equipment - Complexity	Low	Low	High
Information Reliability	Low	High	High ²
Capability to Change Information	Low	Low	High ³

¹ These figures are for comparison purposes only — exact values vary depending upon manufacturer, card size, card reading equipment, etc.

² Assuming tape is deeply embedded in the card. However, such "permanent" magnetic strip cards require expensive card reading devices. If cheaper reading stations are desired, tape must be closer to card's surface thus making it more susceptible to erasure by magnetic force.

³ Assuming tape is not deeply embedded in the card.

In specific details, each manufacturer offers a unique system. But these generally can be classified in terms of operating mode (real-time versus off-line) and input/output records. Using these two factors, alternative automated headcount systems can be grouped into four basic types:

- Type 1: Real-time data processing in which data collection stations are connected directly to a computer main frame.
- Type 2: Real-time data collection in which data collection stations are connected to a central recorder which produces records on computer-compatible magnetic tape.
- Type 3: Off-line data collection in which data collection stations produce tape cassettes. In most instances cassettes must then be collected in a central location and converted to a computer-compatible form before being sent to a computer main frame.
- Type 4: Off-line data collection in which data collection stations produce a paper output. An optical scanner is then used to convert the paper input to magnetic tape output.

Perhaps the most common example of a type 1 (real-time data processing) system is seen by travelers in airports. Information is entered on a data terminal and an answer is received (after a processing step such as checking available seating on a particular flight) at the same terminal. A type 2 system is described in detail in the subsequent section of this report. Off-line paper output systems (type 4) are commonly used in retail stores and service stations.

Table 1 summarizes cost estimates obtained from the aforementioned survey of available data collection/processing systems. Manufacturers' estimates were for a total system (equipment, cards, supplies, etc.) to service 4,000 dining facilities at 600 installations.

The data indicate that off-line cassette output systems (type 3) tend to be least expensive. The most costly automated headcount system would be one in which an optical

scanner is required to convert paper input (such as credit charge slips or meal coupons) to computer-compatible magnetic tape (type 4) systems. Real-time collection systems (type 2) fall in a medium cost range.

A preliminary investigation of type 4 (optical scanner) systems revealed one substantial problem: reliability. According to major oil companies' experience, the proven reliability of the optical scanner is 80%. Two of every ten slips of paper inserted into the scanner cannot be read. The printed information may be incomplete or too faint due, for example, to a nearly flattened embossed card used in the gas station imprinter. For this and other reasons, a type 4 system does not appear to be a desirable alternative to the existing headcount system.

TABLE I

**COST COMPARISON OF ALTERNATE AUTOMATED
HEADCOUNT SYSTEMS - FOR 600 INSTALLATIONS**

		High	Medium	Low
Type I	¹ Real-time Data Processing	\$21.0 m	-	\$8.0 m
Type II	Real-time Data Collection	7.7 m	5.5	2.2 m
Type III	Off-line Cassette	8.6 m	2.8	2.0 m
Type IV	² Off-line Paper/Optical Scanner	15.3 m	5.4	4.8 m

¹ Both figures obtained from one manufacturer.

² Paper supplies not included.

CAFe HEADCOUNT SYSTEMS

Off-Line Cassette System

A preliminary test of an off-line cassette output system was initiated during the CAFe experiment at Fort Lewis. Individuals were issued plastic meal cards in which a numerical identification code was embossed. These cards were read by a data collection terminal which recorded the information on a magnetic tape cassette. When an individual's card was inserted in the machine, a lever raised mechanical fingers according to the pattern embossed on the card. Magnetic heads scanned across the fingers and transferred the information into a visual display. If the card was read correctly, the operator then pushed a button which transferred the information onto a magnetic tape cassette. If not read correctly the first time the operator tried until a correct read was obtained. This obviously caused some delay in getting individuals through the headcount system.

The card reader also had a keyboard which operators could use to 1) enter card or other information manually, or 2) enter food choice data (when the reader was located at the end of the serving line).

Headcounters were instructed to begin each meal with a record of the date, meal and dining facility. At the end of each meal, the operator was required to add a record containing the total headcount for that meal.

Experience with this one type of equipment cannot be considered an adequate test of the off-line cassette output concept. There are, however, some interesting results.

- 1) One day of headcount data (of seven days total operation) was lost through the operators' failure to add required beginning and ending label records to the cassette tape.
- 2) Equipment required to convert the cassettes to computer-readable magnetic tape was not readily available. (The equipment of other manufacturers was not compatible with the card reading equipment.)

- 3) Conversion of the cassette records to punched paper tape required at least one man-hour per day. (Each cassette usually contained one day's headcount comprising approximately 400 records.)
- 4) The time required to record individual meal cards was approximately 7 seconds (from the time a card was taken from and returned to the individual).

Considering these results, off-line cassette systems are not considered the most attractive means of recording headcounts; particularly when the data is required in setting short term food production requirements, and controlling inventory levels as well as in controlling access and accounting for rations.

In addition to the four reasons cited above, another drawback to off-line cassette systems is the potential problem in terms of collecting cassettes from each of the dining facilities. During the CAFE experiment NLABS personnel collected the cassettes. With but 6 dining halls this did not require much in the way of time and personnel. But procedures required to retrieve information captured in 48 dining hall cassette reading stations could become very complex and time consuming. Failure to obtain cassettes from the dining facilities can present serious data losses.

Proposals have been made to issue embossed ID cards to military personnel and dependents. Based on the very limited experience during the CAFE tests at Fort Lewis, the feasibility of an embossed military ID card must be questioned. A small percent of these embossed cards were completely flattened within the short experiment's time span. Thus the information contained on the card was lost -- at least insofar as the card reading equipment is concerned. The usefulness of an embossed ID card for data collection purposes may well be limited.

Real-Time Data Collection System

The basic building blocks of the real-time data collection system most extensively tested at Fort Lewis consisted of the following pieces of equipment:

- 1) card reading stations
- 2) variable entry data stations

3) central polling device

4) magnetic tape drives with keyboard entry capability.

Figure 2 shows how these devices were linked together to record headcount information directly onto magnetic tape.

Card reading stations were located in each dining hall in the immediate vicinity of the entrance. Variable entry data stations were located at the end of the serving line — in the position cash registers normally occupy in commercial restaurants. These two kinds of equipment were wired directly to the central polling device. The central polling device was in turn connected to two magnetic tape drives similar to those found in any computer center.

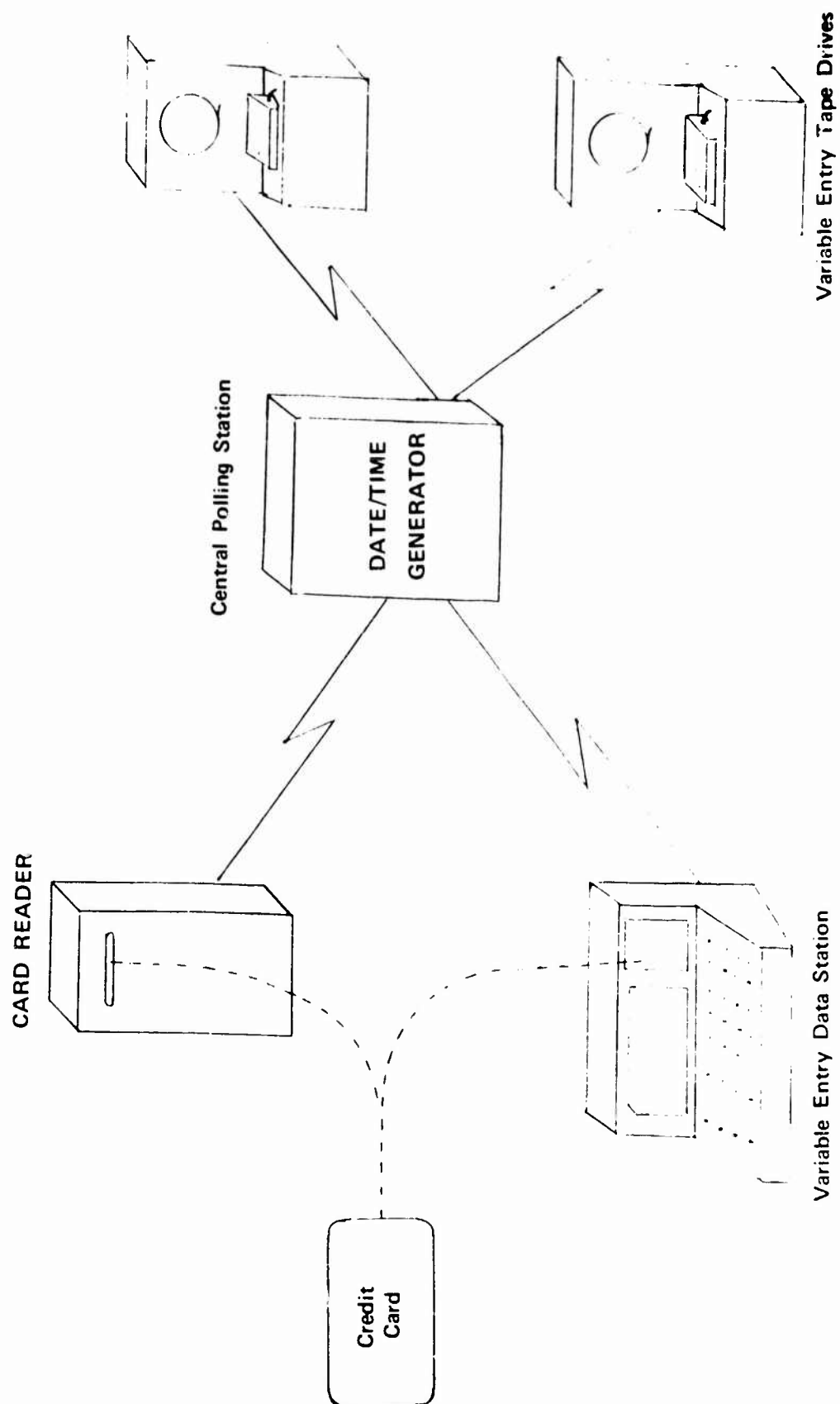
Each individual authorized rations-in-kind during the CAFE experiment was provided with a plastic meal card. His name, social security account number, and unit were embossed on the card. In addition, his social security number, unit, and a special code to indicate rations-in-kind were punched on the card. The hole-punches are identical to those used to encode information on the more familiar IBM 80 column paper cards.

When an individual entered the dining hall, he merely inserted his plastic card into the card reading station. At that point, his social security number, unit and rations-in-kind codes were recorded onto the magnetic tape by the central polling device.

Additional information was also recorded at the same time. The central polling device was equipped with a date/time generator. Each card reading station added codes unique to its location. Whenever an individual inserted his meal card, therefore, the following data were entered onto magnetic tape:

- a) social security number
- b) authorized to subsist code
- c) unit identification code

FIGURE 2 DATA COLLECTION SYSTEM



- d) date
- e) time that the card was inserted
- f) location or dining hall that received the card
- g) valid or invalid message code.¹

Variable entry data stations were utilized to collect food choice information. When these data were being acquired it was not necessary for an individual to insert his card upon entering the dining hall. Instead, his card was handed to an attendant at the end of the serving line. The card was inserted into a machine, his food choices were keyed in on the same machine and the data were transmitted to the central polling station.

The equipment described above allowed management to determine:

- 1) who ate — or did not eat
- 2) what food items —
- 3) at what meals —
- 4) in which dining halls.

This information is vital to effective management of a consumer-oriented centralized food preparation facility. Its obvious applications are in demand forecasting, menu planning, ration accounting and control, nutritional analysis and inventory management.

¹When for various reasons all of the information on an individual's meal card did not reach the central polling station, the message was still written onto the magnetic tape with the addition of the invalid message code. In these cases, a red light appeared at the card reading station and the individual was required to re-insert his card until a green light appeared. As a check procedure, this feature of the equipment proved quite useful.

It is important to emphasize the difference between real-time data collection and real-time data processing. The food service system objectives do not absolutely require real-time data processing. There is no need, for example, to wire each dining hall card reader to a computer main frame so that invalid cards are immediately identified. It is important, however, to capture headcount records on computer compatible tape so that checks for unauthorized access can be produced within a short time after the meal. Other food service management information requirements are equally well served by a real time data collection as by a real-time data processing system.

For at least two reasons, a real-time data collection system is a preferable approach to eliminating the signature requirement while satisfying the total food service system objectives.

- 1) Increased reliability through fewer input/output transformations, and simpler procedures.
- 2) Decreased time delays in collecting analyzing, and reporting information.

ACCESS CONTROL

Signature Headcount System

Under existing regulations, the primary control of access to dining facilities rests with the headcounter. While the dining steward has overall responsibility, it is the headcounter who must:

- 1) check DD Form 714 (meal card) or require identification to ensure that only authorized personnel use the dining hall facilities,
- 2) assure that everyone authorized to subsist without reimbursement legibly signs his name, unit, grade and meal card number on the numbered lines of DA Form 3351 (Signature Headcount Sheet),
- 3) assures that those on separate rations legibly sign DA Form 1544 (Cash Collections Sheets) and pay the appropriate meal charges.

It is fair to add that unit commanders also share responsibility for controlling access to Army dining facilities. It is the unit commander's responsibility to assure that unauthorized personnel are not issued DD Form 714 meal cards.

The above procedures, when followed, prevent unauthorized access to dining facilities. In actual operations, the system is ineffective.

Table I summarizes a survey of Fort Lewis dining hall records. Two weeks of data from two dining halls at Fort Lewis were examined. Theoretically, an individual's meal card should appear once, twice, or not at all for any given day and meal combination (e.g. Monday, Breakfast). There were, for example, two Monday breakfasts during the two week comparison period. Yet some meal cards were recorded three or more times during the breakfast meals on the two Mondays.

The results summarized in Table I show several things. First, the controls specified in AR 30-1 are unevenly applied. If meal cards that appear more often than expected

TABLE II

**PROBABLE UNAUTHORIZED ACCESS RATES IN DINING HALLS
USING THE SIGNATURE HEADCOUNT SYSTEM**

	Highest	Lowest	Average (Median)
Building 1	11.3%	0.0%	2.0%
Building 2	14.0%	0.8%	7.0%

constitutes possible unauthorized access, the extent of this problem differs markedly in the two dining halls. Of those authorized rations-in-kind, as many as 14% appeared with unusual frequency in one dining hall. The highest figure in the other dining hall was 11%. In one dining hall, percentages of 7% and 9% were common. In the other dining hall, percentages were often less than 1%.

While the above estimates are based upon a very limited sample — both in terms of time span and dining facilities included — they are intriguing. At a minimum, they indicate that the dollar losses associated with unauthorized access under the present signature headcount system are significant.

Automated Headcount System

With the existing manual signature headcount system, determining the extent of unauthorized access or use of dining facilities is a time-consuming and burdensome task. The real-time data collection system utilized during the CAFe tests at Fort Lewis significantly reduced the labor and time required to identify those individuals who may have been abusing the system.

In order to determine whether meal cards have appeared unusually often in the present system, signature sheets and guest registers and cash collection records must be deciphered and searched by visual clerical means. In an automated system, such as that described previously, the individual social security numbers from meal cards are on computer compatible magnetic tape. Management has only to request a computer run to list meal cards which appeared more than once during the meal.

Such a computer program was developed during the Fort Lewis experiment. The output of this program is the Unusual Usage Report presented in Figure 3. Each record on the computer tape contained the individual's social security number, dining hall location, time and date data. A listing of those cards that were recorded more than one time within one hour anywhere in the CAFe system (6 dining halls) is therefore, easily attained.

Table III summarizes data obtained from the "UNUSUAL USAGE" computer program described above. Two sets of figures are reported. Those for Building #1 are the results

FIGURE 3

UNUSUAL USAGE REPORT

PERIOD COVERED: 15-31 MAR 72

**864 ENG BN
22ND ENG CO**

SOCIAL SECURITY NO	DAY	DATE	FACILITY	TIME
123456789	Saturday	18 Mar	3114	0800
			3114	0830
	Sunday	19 Mar	3114	0758
			3114	0850
234567891	Sunday	26 Mar	3218	1903
			3218	1949
345678912	Monday	27 Mar	3114	1629
			3114	1700
456789123	Tuesday	28 Mar	3114	1715
			3218	1757

1. **Note:** Social security numbers have been disguised.

TABLE III

PROBABLE UNAUTHORIZED ACCESS RATES IN DINING HALLS
USING AN AUTOMATED HEADCOUNT SYSTEM

	Highest	Lowest	Average (Median)
Building 2	2.0%	0.0%	0.7%
Overall (6 Dining Facilities combined)	2.0%	0.0%	—

Note: The overall percent was arrived at by dividing the number of cards which appeared 2 or more times within an hour at any CAFe facility by the total number of cards recorded.

from two weeks of data collected during December, 1971. The other data collected from six dining halls during the month of March, 1972, was subjected to analysis with the same results — a 2% unauthorized access rate.

The most striking feature of these results is that unauthorized access — as potentially indicated by meal cards appearing unusually often — is markedly reduced under the automated headcount system. The highest figure obtained under the automated system was 2%, which is highly significant, when compared to the 14% obtained in the manual signature headcount system.

The reduction may appear surprising in view of the fact that no attempt was made to punish individuals whose card numbers appeared on the computer listing. Yet there is some logical basis for these results. Perhaps individuals are less likely to loan or illegally retain their meal cards when it is clear that card records are computerized. (Soldiers may realize as fully as do others that information on computer tapes can be very quickly processed.) In the present manual system individuals may perceive correctly that signature headcount sheets are time consuming and difficult to analyze. A card or signature appearing simultaneously at two locations — or twice within the same location — can avoid detection for some time.

Monetary Losses from Unauthorized Access

While cost-effectiveness was not a primary consideration in the search for an alternative headcount system, the data in Tables II and III suggest that savings could accrue from an automated system. The highest rate of unauthorized usage observed under the automated system was 2% — remembering of course that the data base was limited. Under the manual system, a 7% rate was obtained as a median value.

If these two percentages are a reasonable representation of conditions under automated and manual headcount systems, the losses associated with unauthorized meals would approximate the values reported in Table IV. These figures were projected to a 24,000 meal per day facility. Losses under the present manual system would be approximately \$338,000 per year. The comparable figure under an automated system would be approximately \$99,600 per year. The difference, \$238,400 would more than equal the purchase cost of an automated system such as that proposed for centralized feeding facilities.

TABLE IV

**COMPARISON OF MANUAL AND AUTOMATED HEADCOUNT PROCEDURES
IN A 24,000 MEAL PER DAY CENTRAL FOOD PREPARATION FACILITY**

	Manual	Automated
Unauthorized Meals	1680	480
Cost per Day (BDFA = \$1.51)	\$926.52	\$264.72
Cost per Year	\$338,179.80	\$99,621.80
DIFFERENCE		\$238,558.00

Note: Meal costs were computed by multiplying the total unauthorized meals and the BDFA by 20%, 45% and 35% to obtain approximate breakfast, dinner and supper costs.

ACCOUNTING FOR RATIONS FED

Signature Headcount System

Since the existing system is fully described in documents such as AR 30-1, only two points need to be summarized at this point.

Dining hall records are reviewed quarterly. The reviewing officer must make spot checks of signatures, company rosters, and meal cards to assure that the reported figures are correct.

Second, it seems fair to say that the thoroughness of these quarterly reviews depends greatly upon the skill, motivation, and abilities of reviewing officers. As we have shown in discussing the percentages of unauthorized access, the quality of quarterly reviews also varies from one dining hall to another.

Automated Headcount System

To those who have attempted to interpret handwritten signatures — and then to match them against company rosters — it is hardly necessary to argue that there must be a better way. Though not the most important, one advantage of an automated system based upon machine-readable meal cards is that records are uniformly legible. Machines are much more capable of assuring legibility than are regulations.

The most significant advantage to be gained from an automated headcount system is that the quality of audit reviews can be set at high levels and can be assured. The number and kinds of audit tests are fixed in the computer programs written to accomplish the quarterly (or other periodic) reviews. They are not left to the motivation and skill of individual reviewers. Reviewing officers are still required in an automated system. But much of the clerical work is accomplished by computer programs which also assure that prescribed tests are accomplished — provided of course that the programs are used. One example will serve to illustrate this point. The present regulations require "spot checks" to verify that only those authorized rations-in-kind signed the signature sheets. To accomplish this spot check, the reviewer must check signatures against company rosters. It should be noted that as dining halls are consolidated, the number of signatures and company rosters to be checked increases significantly. This "spot check" thus requires no small amount of effort.

Under an automated system, this audit test would be in part performed by a computer program. The number of records to be examined, and the number and kind of tests could be specified in the program. Records from the personnel file on magnetic tape would be compared with records from the dining hall headcount tape according to the specified audit tests. One such test would be for mismatches wherein a meal card issued to a rations-in-kind individual appeared in the dining hall on a date after the individual has been authorized separate rations. Where the number of records examined in the spot check is now left to the diligence of the reviewing officer, a more uniform review could be assured in a computerized audit. Each time the program is run, the "spot check" is the same in terms of such auditing parameters as the number of records reviewed.

CASH COLLECTIONS

Any automated equipment and system design to collect headcount data should also have the capacity to remove cash collections from the dining hall. As mentioned in the Introduction to this report, the application of the CAFe data collection system to the cash collection problem was not tested. At this point, it can only be said that the application is technologically feasible.

During the CAFe experiment, variable entry data stations were utilized to collect individual food choices for purposes of menu planning and food demand forecasting. The same equipment could be utilized to remove cash collections in the following manner.

Each individual's food item choices and meal attendance was captured on magnetic tape. An example of these records is contained in Figure 4(a).

If current procedures are followed, data would be summarized over some specified time interval. A card or tape record would be produced for each individual. This record would contain the following data:

- 1) name
- 2) social security account number
- 3) dates
- 4) meals attended.

From this information, meal charges are easily computed.

- (a) Building column contains the dining facility number code; date is in Julian days; choices represent food items in a number-position code; SSNO is the individual's social security number; and unit is a numerically coded company, e.g. 021 = Co A 58th Signal Group.

FIGURE 4
INDIVIDUAL MEAL ATTENDANCE AND FOOD CHOICE RECORD

BLG	MEAL	DATE	CHOICE	SSNO	UNIT
328	MID-DAY	088	001111111	543534576	122
328	MID-DAY	088	002111001	233814665	124
328	MID-DAY	088	012211100	534537559	123
328	MID-DAY	088	001111001	503646296	123
328	MID-DAY	088	002111101	295430922	121
328	MID-DAY	088	000011102	999999109	121
328	MID-DAY	088	000111101	945003321	123
328	MID-DAY	088	000111101	433882922	123
328	MID-DAY	088	010001000	133302255	121
328	MID-DAY	088	011111100	465955079	121
328	MID-DAY	088	000011101	543627469	123
328	MID-DAY	088	010111000	566923728	124
328	MID-DAY	088	012011000	453713367	121
328	MID-DAY	088	000010001	534425673	121
328	MID-DAY	088	000111101	543652905	123
328	MID-DAY	088	002111001	187423187	121
328	MID-DAY	088	002111001	583650232	123
328	MID-DAY	088	001111101	285501223	124
328	MID-DAY	088	011011000	436322959	121
328	MID-DAY	088	000111002	266189734	121
328	MID-DAY	088	000011102	234360731	121
328	MID-DAY	088	001111101	234334331	122
328	MID-DAY	088	001111101	543610020	123
328	MID-DAY	088	001111103	543633297	123
328	MID-DAY	088	001011101	535541155	123
328	MID-DAY	088	011101100	564833716	123
328	MID-DAY	088	000011101	535525510	123
328	MID-DAY	088	012211100	545813517	123
328	MID-DAY	088	011111000	513652209	122
328	MID-DAY	088	000010001	555767593	122
328	MID-DAY	088	000111001	212557183	124
328	MID-DAY	088	001111101	572631301	122
328	MID-DAY	088	021111100	249931985	124
328	MID-DAY	088	000011001	544626359	125
328	MID-DAY	088	002211101	552136152	124
328	MID-DAY	088	022211100	565900345	122
328	MID-DAY	088	002211002	555947523	123
328	MID-DAY	088	011111000	254313796	123
328	MID-DAY	088	010111100	539554351	125
328	MID-DAY	088	002211102	999999001	123
328	MID-DAY	088	010211100	565946064	123
328	MID-DAY	088	000111100	541648792	125
328	MID-DAY	088	011111100	527624773	125
328	MID-DAY	088	010111100	530448418	125
328	MID-DAY	088	011111100	527733624	124
328	MID-DAY	088	020211100	311537335	122
328	MID-DAY	088	000211001	535551133	122
328	MID-DAY	088	001111101	555809984	122

Whether appropriate meal charges and surcharges are collected would thus no longer be controlled by a headcounter at the dining facility who may or may not be properly instructed by the dining steward. Control can be shifted to more knowledgeable authorities; e.g. Finance Center, US Army (FCUSA). Further, the controls would be more uniformly applied with one billing agent rather than the present multitude of headcount cashiers.

As indicated by Figure 4, the automated data collection system utilized at Fort Lewis could provide information not only upon meals, but also upon specific food items. Thus, management has the capability to compute charges on the basis of food items (e.g. 30¢ for a hamburger) rather than upon meals (e.g. one Short Order meal) as is the current practice.

The interface between an automated headcount system and the JUMPS programs is by no means a simple problem. It is, however, technologically feasible. Further, progress depends on policy decisions yet to be made, e.g. food charges by meal or food item. In summary, we can only suggest some of these areas in which policy decisions are required:

- 1) billing — collection procedures
- 2) amount and kind of information exchange between installations and FCUSA
- 3) issue and control of meal credit cards
- 4) other uses of meal credit cards, e.g. commissary resale operations.

SUMMARY AND CONCLUSIONS

This report has described an automated headcount system. It was developed in connection with the CAFe tests at Fort Lewis. The major findings have been:

- 1) a fully automated headcount system is feasible with presently available "off-the-shelf" equipment
- 2) limited data suggest that machine-readable meal cards substantially decrease unauthorized usage of dining facilities
- 3) subject to procedural policies not yet defined, the same system used to account for rations-in-kind can be utilized for cash collections
- 4) an automated headcount system reduces troop irritants to the extent that it greatly reduced the waiting lines formed at the headcounter's station. This is particularly important during inclement weather when waiting lines extend outdoors
- 5) a fully automated headcount system appears, again on the basis of limited data, to reduce dollar losses associated with unauthorized meals served.

LIST OF REFERENCES

Army Regulation 30-1 "The Army Food Service Program", HQ Department of the Army, Washington, DC, November 1969.

Smith, et. al., "A System Evaluation of Army Garrison Feeding at Fort Lewis, Washington", Technical Report 72-37-OR&SA.

DA Circular 37-67, "Implementing Instructions For Joint Uniform Military Pay System - Army (JUMPS - Army)", September 1971.